

CLAIMS

1. A method for use in a radio network that employs adaptive antennas, comprising:

for a connection with a first mobile station, determining an amount of information to be transmitted in an uplink direction by the first mobile station to the radio network;

if the amount of uplink information is less than a predetermined value, sending to the first mobile station a permission to transmit a first amount of information; and

if the amount of uplink information is equal to or exceeds the predetermined value, sending to the first mobile station a permission to transmit a second amount of information greater than the first amount to reduce a number of times permission to transmit must be sent to the first mobile station.

2. The method in claim 1, wherein the permission to transmit is a flag.

3. The method in claim 2, wherein the permission to transmit is an uplink state flag (USF).

4. The method in claim 3, wherein if the amount of uplink information is less than the predetermined value, a lower USF granularity is sent to the first mobile station, and if the amount of uplink information is equal to or exceeds the predetermined value, a higher USF granularity is sent to the first mobile station.

5. The method in claim 4, wherein the lower USF granularity is a granularity of one USF per one radio block to be transmitted uplink, and the higher USF granularity is a granularity of one USF per four radio blocks to be transmitted uplink.

6. The method in claim 1, further comprising:
determining whether first information having a first level of coding is to be transmitted in a downlink direction from the radio network to the first mobile station associated with a first antenna beam;

determining whether second information having less coding than the first information is to be transmitted in a downlink direction from the radio network to a

second mobile station associated with a second antenna beam;

combining the first and second information in a data block; and

transmitting the data block in the second antenna beam.

7. The method in claim 6, wherein the first information is a permission to transmit in the uplink and the second information is payload data.

8. The method in claim 6, further comprising:

storing the first information for plural mobile stations;

storing the second information for plural mobile stations;

determining an antenna beam associated with each of the mobile stations;

identifying first information and second information for one of the mobile stations; and

sending the first and second information in a data block to the one mobile station using the associated antenna beam.

9. The method in claim 8, further comprising:

identifying first and second information for different mobile stations associated with a same antenna beam, and

sending the first and second information in a data block to the different mobile stations using the same antenna beam.

10. The method in claim 1, further comprising:

determining whether first information is to be transmitted in a downlink direction from the radio network to the first mobile station associated with a first antenna beam;

determining whether second information is to be transmitted in a downlink direction from the radio network to a second mobile station associated with a second antenna beam;

combining the first information with dummy second information into a first data unit; and

sending the first data unit to the first mobile station using the first antenna beam.

11. The method in claim 10, further comprising:
combining the second information with dummy first information into a second data unit; and
sending the second data unit to the second mobile station using the second antenna beam.

12. A method for use in a radio network that employs adaptive antennas, comprising: When two pieces of information, with different amounts of coding, are packet in the same data block and are intended for two different antenna beams, the beam pointing in the direction of the mobile with the least coding should be used for the transmission

determining whether first information with a first amount of coding is to be sent in a downlink direction from the radio network to the first mobile station associated with a first antenna beam;

determining whether a second information with a second amount of coding less than the first amount of coding is to be transmitted in a downlink direction from the radio network to a second mobile station associated with a second antenna beam;

combining the first and the second information in a data block; and
transmitting the data block in the second antenna beam.

13. The method in claim 12, wherein the first information is permission to transmit uplink information and the second information is payload information, the method further comprising:

storing the permission to transmit uplink information for plural mobile stations;

storing the payload information for plural mobile stations;

determining an antenna beam associated with each of the mobile stations;

identifying the permission to transmit and payload information for one of the mobile stations; and

sending the permission to transmit and payload information in a data block to the one mobile station using the associated antenna beam.

14. The method in claim 13, further comprising:

identifying permission to transmit and payload information for different mobile stations associated with a same antenna beam, and

sending the permission to transmit and payload information in a data block to the different mobile stations using the same antenna beam.

15. Apparatus for use in a radio network and configured to communicate with at least one radio base station that employs adaptive antennas, comprising:

a connection controller for establishing a connection with a first mobile station by way of the radio base station;

a data controller configured to perform the following tasks:

determine an amount of information to be transmitted in an uplink direction by the first mobile station to the radio base station;

if the amount of uplink information is less than a predetermined value, generate a message for the first mobile station including a permission to transmit a first amount of information; and

if the amount of uplink information is equal to or exceeds the predetermined value, generate a message for the first mobile station including a permission to transmit a second amount of information greater than the first amount to reduce a number of times a permission to transmit must be sent to the first mobile station.

16. The apparatus in claim 15, wherein the permission to transmit is a flag.

17. The apparatus in claim 16, wherein the permission to transmit is an uplink state flag (USF).

18. The apparatus in claim 17, wherein if the amount of uplink information is less than the predetermined value, the message includes a lower USF granularity, and if the amount of uplink information is equal to or exceeds the predetermined value, the message includes a higher USF granularity.

19. The apparatus in claim 18, wherein the lower USF granularity is a granularity of one USF per one radio block to be transmitted uplink, and the higher USF granularity is a granularity of one USF per four radio blocks to be transmitted uplink.

20. A radio communications system incorporating the apparatus in 15, further comprising the radio network, the radio base station that employs adaptive antennas, and the first mobile station.

21. The apparatus in claim 15, wherein the data controller is further configured to:

- determine whether first information having a first level of coding is to be transmitted in a downlink direction from the radio base station to the first mobile station associated with a first antenna beam of the radio base station;

- determine whether second information having less coding than the first information is to be transmitted in a downlink direction from the radio base station to a second mobile station associated with a second antenna beam of the radio base station;

- combine the first and second information into a data block; and

- send the data block transmission to the radio base station for transmission using the second antenna beam.

22. The apparatus in claim 21, wherein the first information is a permission to transmit in the uplink and the second information is payload data.

23. The apparatus in claim 21, further comprising:

- a first buffer for storing the first information for plural mobile stations;

- a second buffer for storing the second information for plural mobile stations, the data controller being further configured to:

- determine an antenna beam associated with each of the mobile stations;

- identify first information and second information for one of the mobile stations; and

- prepare the first and second information in a data block to be transmitted to the one mobile station using the associated antenna beam.

24. The apparatus in claim 23, the data controller being further configured to:
identify first and second information for different mobile stations
associated with a same antenna beam, and
prepare the first and second information in a data block for transmission to
the different mobile stations using the same antenna beam.

25. The apparatus in claim 15, wherein the data controller is further
configured to:
determine whether first information is to be transmitted in a downlink
direction from the radio base station to the first mobile station associated with a first
antenna beam of the radio base station;
determine whether second information is to be transmitted in a downlink
direction from the radio base station to a second mobile station associated with a second
antenna beam of the radio base station;
combine the first information with dummy second information into a first
data unit; and
prepare the first data unit to be sent to the first mobile station using the
first antenna beam.

26. The apparatus in claim 25, wherein the data controller is further
configured to:
combine the second information with dummy first information into a
second data unit; and
prepare the second data unit to be sent to the second mobile station using
the second antenna beam.

27. A node for use in a radio network that employs adaptive antennas,
comprising electronic circuitry configured to:
determine whether first information with a first amount of coding is to be
sent in a downlink direction from the radio network to the first mobile station associated
with a first antenna beam;
determine whether second information with a second amount of coding

less than the first amount of coding is to be transmitted in a downlink direction from the radio network to a second mobile station associated with a second antenna beam;

combine the first information and the second information in a data block;

and

assign the data block for transmission in the second antenna beam.

28. The node in claim 27, wherein the first information is permission to transmit uplink information and the second information is payload information, the electronic circuitry being further configured to:

store the permission to transmit uplink information for plural mobile stations;

store the payload information for plural mobile stations;

determine which antenna beam is associated with each of the mobile stations;

identify the permission to transmit and payload information for one of the mobile stations; and

combine the permission to transmit and payload information in a data block for transmission to the one mobile station using the associated antenna beam.

29. The node in claim 27, wherein the first information is permission to transmit uplink information and the second information is payload information, the electronic circuitry being further configured to:

identify permission to transmit and payload information for different ones of the mobile stations associated with a same antenna beam, and

combine the permission to transmit and payload information in a data block for transmission to the different mobile stations using the same antenna beam.

30. A radio communications system incorporating the node in 27, further comprising the radio network, an antenna array for generating the first and second antenna beams, and the first and second mobile stations, wherein the node is a base station control node coupled to or coincident with the radio base station.